

ILLUSTRATIONS OF THE AEDEAGI OF THE LAMPYRIDAE (COLEOPTERA)

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The three principal genera of the Photurinae, *Bicellonycha*, *Photuris*, and *Pyrogaster*, which have very similar facies, have been separated on the basis of the structure of the claws of the male; *Bicellonycha* has both claws bifid at the tips; *Photuris* has only one claw bifid, and *Pyrogaster* has simple claws (E. Olivier, 1911, pp. 103-107). Examination of the aedeagi also shows that this organ as well as the claws differ in the three genera.

Barber (1951, pp. 19-21) noted that the aedeagi of the North American species of *Photuris* are essentially identical; also that of *P. jamaicensis* E. Olivier is of the same pattern (McDermott and Buck, 1959, p. 6, fig. 63). The aedeagi of three tropical species, *P. annulicornis* Boheman, *P. mollis* Gorham, and an unidentified South American species, have been extracted. The dorsal and ventral aspects of these aedeagi are so similar to those of the North American species that it is not deemed necessary to illustrate them, but the generally similar lateral views are shown (figure 1).

In view of the almost identical structure of the aedeagi in obviously different species of *Photuris* it appears that the only isolating mechanism is the specific flashing pattern described by Barber. Information on the flashing of species in Central and South America is unfortunately lacking, and the usual simple flash of *P. jamaicensis* is sufficient in the absence of other congeneric species in that Island.

The aedeagi of five species of *Bicellonycha*, *B. mexicana* Gorham, *B. collaris* Gorham, *B. amoena* Gorham, *B. gibba* Pic, and *B. lineola* Blanchard have been extracted and the dorsal, lateral, and ventral views of each are shown (figures 2 to 6). The aedeagi of these species of *Bicellonycha* differ distinctly from those of *Photuris* not only in general form but also in the absence of the two long, thin lateral processes characteristic of the latter genus. Green (1959, p. 93) has noted that similar processes are present on the aedeagi of *Vesta* spp., but in the latter case they are attached to the lateral lobes at about midlength instead of extending to the base as in *Photuris*. While there are specific differences in this organ in *Bicellonycha*, the general form is similar.

Presbyolampis Buck (1947, pp. 76-77, pl. 3, fig. 25) has all claws bifid and would apparently be *Bicellonycha* on superficial appearance, but there are some differences from the latter in addition to the aedeagus and it seems to constitute a subgenus.

Two species of *Pyrogaster* were available for dissection, *P. squalidus* E. Olivier (figure 7), and *P. moestus* (Perty) (figure 8). These aedeagi are obviously different from those of *Photuris* and *Bicellonycha*.

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Macrolampis Motschulsky (I, 1853, p. 37) resembles an elongated *Photinus* and was not distinguished from the latter by Gorham (1880, p. 24; 1881, pp. 41, 261). The principal easily recognized character is the longer eighth visible ventral abdominal plate of *Macrolampis*, in addition to its narrow, elongate outline, but neither is entirely reliable. Most known females of *Macrolampis* are larviform, but this does not separate it from *Photinus*, and indeed Motschulsky (II, 1854, p. 37) included as *Macrolampis* the common *Photinus scintillans* Say of the eastern United States. *P. collustrans* LeConte, an elongate, narrow species with a brachelytral female, more likely should be included in *Macrolampis*.

The aedeagi of the North American species of *Photinus* have been illustrated by Green (1956), and those of the Jamaican species by McDermott and Buck (1959). Barber (1941, p. 4) gives a general description of the structure. I have removed the aedeagi of *Macrolampis olivieri* Pic and of *M. attenuata* Gorham (figures 9 and 10 respectively). The aedeagus of the former is quite definitely not of the photinoid pattern. The drawings do not show clearly the peculiar divergence of the lateral and median lobes as seen under the microscope, although it is partially indicated in the apical view (fig. 9D) which shows the sharp hooks on the lateral lobes. Several preparations from different specimens gave the same structure. The aedeagus is small, only 0.9 mm. long, in a body 15 mm. long. In this species the males completely lack luminous organs, while the females are larviform with very short, dark elytra, and the penultimate and antepenultimate ventral abdominal plates are luminous. However, in *M. longipennis* Motschulsky, the type of the genus, the males have the penultimate and antepenultimate ventral abdominal plates luminous as in *Photinus*, but the female is brachelytral. In *M. attenuata*, *M. extensa*, and *M. volcanica*, all described as *Photinus* by Gorham, the sixth and seventh visible ventral abdominal plates are luminous as in *Photinus*. The female of *attenuata* was not known to Gorham, but that of *extensa* is brachelytral and luminous from a spot on the sixth visible ventral abdominal plate, while in *volcanica* the female is alate and luminous from the sixth. This arrangement of the luminous organs suggests that these species are properly *Photinus*, and the aedeagus of *attenuata* (figure 10) is rather clearly of the photinoid type. This also proves to be true of the organ of *extensa*, which is quite similar; in *volcanica* the minute size of the aedeagus renders comparison difficult, but it appears to resemble that of *M. olivieri* Pic in the divergent lateral lobes and distinctly separated median lobe, which supports its assignment in *Macrolampis* in spite of the alate female.

Other species of *Macrolampis* were not available for dissection but it appears probable that they are definitely distinct from *Photinus* on the basis of aedeagal structure.

Barber (1941, p. 4) put a series of Jamaican lampyrids in a new genus, *Diphotus*, distinguished from *Photinus* by having functional luminous organs only on the eighth visible ventral abdominal plate. McDermott (1955, p. 49) extended this genus to include other Antillean species, including *Heterophotinus limbipennis* DuVal. This would give *Heterophotinus* E. Olivier (1894, p. 24) priority over Barber's *Diphotus*; however, pending further information, the use of *Diphotus* for the Jamaican

species was continued by McDermott and Buck (1959). The aedeagus of *H. limbipennis* has been extracted, mounted, and is shown (figure 11). When withdrawn, but before treatment with caustic, the aedeagus is very similar to that of *Diphotus dahlgreni* Buck (1947), but subsequent treatment darkened and distorted it, producing a deflected median lobe which causes it to somewhat resemble the aedeagus of *Pyrogaster squalidus* Olivier, to which it is not closely related. However, the resemblance is sufficiently close to that of other *Diphotus* species to make it fairly certain that it compares with the shorter form of the organ in the latter genus and that the two genera are the same. In this case also, the presence of larviform females is not a generic character.

The lampyrids which are today listed under *Lucidota* Laporte are rather obviously a composite of species which are not very evidently congeneric. By separating as valid the genera *Ellychnia* and *Pyropyga* and by referring to *Leucothrix* E. Olivier (1911, p. 72) those species which have pale distal antennal segments, even though this character is of doubtful generic significance, the number of species in *Lucidota* is considerably reduced. The remainder are still heterogeneous.

Laporte (1833, p. 136) gives the following as some of the characters of the genus: "Antennae almost as long as the body, broad, very compressed, each with a fairly long branch . . . body elongate . . . mandibles somewhat prominent . . . pronotum slightly angulate in front . . . elytra elongate, almost parallel . . . abdomen usually with the last two segments luminous." Lacordaire (1857, pp. 318-319) says that the antennae are flabellate to feebly dentate, and the luminosity feeble. Leng and Mutchler (1922, p. 435) somewhat doubtfully regard strongly serrate antennae in the male as complying with the specifications for *Lucidota*. E. Olivier (1907) says the antennae in the male are dentate, sometimes with a rather long, elliptical, and compressed branch. LeConte (1881, p. 31) speaks of the broadly compressed, not serrate antennae, and the feeble development of the luminous organs, but says that the genonym should probably be rejected for the North American species. Gorham (1881, p. 34) says that there are two divisions of *Lucidota* differing in the structure of the apical ventral segments, and that the antennae of both are often long, pectinate or serrate.

The type species of *Lucidota*, *L. banoni*, from Cayenne, is described briefly by Laporte (1833, p. 137) as measuring 12.7 mm. long by 4.2 mm. wide, black; pronotum, scutellum, thorax beneath, femora, and end of abdomen yellow-orange. E. Olivier (1885, p. 336) however says that the thorax, scutellum, abdomen, and legs are black; the last ventral abdominal plate with a white spot on each side, and the antepenultimate with a medio-basal white spot. (This would not indicate pronounced luminosity.)

With these varying characterizations, it is perhaps not surprising that the species assigned to *Lucidota sensu lato* show a wide variation in facies and structure. Laporte originally included in *Lucidota* the species *flabellicornis* Fabricius, *appendiculata* Germar, *compressicornis* Fabricius, *banoni* Laporte, *limbata* Laporte, *modesta* Laporte, *thoracica* Laporte, and *antennata* Laporte; of these, Olivier (1910) referred *limbata* and *modesta* to *Aethra*, leaving the others in *Lucidota* but changing *thoracica* to *pennata* Dejean, the former being preoccupied by *thoracica* G. A. Olivier.

The aedeagi have been extracted from several species listed in *Lucidota*, and as might be expected, they show a variety of forms. E. Olivier (1911, p. 71) segregated our common North American species *L. atra* G. A. Olivier and *L. punctata* LeConte in a proposed new genus, *Rileya*. The aedeagus of *L. atra* is shown (figure 12), and those of other species as follows: *L. diaphanura* Gorham (figure 13); *L. discolor* Gorham (figure 14); *L. thoracica* G. A. Olivier (figure 15). It will readily be seen that no two of these species have similar aedeagi, which tends to confirm the heterogeneous nature of the genus. The organ in *L. thoracica* G. A. Olivier indicates that this species belongs properly in *Vesta*, as mentioned to me by Mr. J. W. Green, and that of *L. discolor* Gorham suggests the unrelated *Lucernuta* by its short lateral processes. The aedeagus of *L. atra* G. A. Olivier is generally similar to that of *Pyraclonema bifenestrata* Fairmaire and Germain (McDermott 1960), and the latter is to some degree similar to that of *Lucidina puerile* E. Olivier of Japan (figure 16). The aedeagus of *L. bicellonycha* McD. (1958) somewhat suggests a curved form of that of *L. atra*. For comparison, the aedeagus of *Ellychnia corrusca* Linnaeus is also shown (figure 17).

Luciola is at present the most numerous genus in the Lampyridae, with about 265 species. There are several derivative genera, *Colophotia*, *Pyrophanes*, *Pteroptyx*, and *Curtos*, with the same abdominal structure of six visible ventral abdominal plates but with rather elaborate modifications of the last segment. Among the simpler of such modifications is that of *Colophotia* in which the apical ventral abdominal plate bears two parallel longitudinal hooked carinae with a slot between them through which projects a triangular plate. In at least some species there are also two other hooks laterad of the carinae. Some species with hooked projections or other modifications are still listed as *Luciola*.

The aedeagi have been extracted from *Luciola chinensis* Linnaeus, from India, *L. melaspis* Bourgeois, from India, and *L. cruciata* Motschulsky from Japan (figures 18, 19, and 20 respectively). That of *L. cruciata* is somewhat suggestive of the photinoid type.

Luciola ovalis Hope is described as having two lateral plates on the last abdominal sternite. The ventral appearance of the last segments of this species is shown in figure 21, the luminous areas being the unshaded fifth segment and the subcircular plates on the sixth. In most species of *Luciola* the sixth visible ventral abdominal plate is either integral or at most with a longitudinal line. It would appear that a subdivision of *Luciola* based on these differences might be made.

The aedeagus of *Colophotia praeusta* Eschscholtz (figure 22) and that of *C. concolor* E. Olivier, both species from the Philippines, are similar but the latter is rather narrower. In this genus the appearance of the last ventral abdominal plate is perhaps of more interest than the aedeagus (figure 23) which in a lateral view shows the projecting aedeagus and the triangular plate projecting through the slot; the dorsal view shows the pygidium (shaded). The entire arrangement is quite complicated and probably accounts for Motschulsky's comment that the genitalia are external.

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FIGURES 1-23. Aedeagi and a few terminal abdominal segments of Lampyridae. Where not otherwise indicated, figures are of aedeagi. In all figures, "a" is dorsal view, "b" is lateral view, "c" is ventral view, and "d" is apical view, except figure 1 where the view is indicated. 1—*a*, *Photuris annulicornis* Boheman, lateral view; *b*, *Photuris mollis* Gorham, lateral view; *c*, *Photuris* sp., lateral view. 2—*Bicellonycha mexicana* Gorham. 3—*Bicellonycha collaris* Gorham. *Bicellonycha amoena* Gorham. 5—*Bicellonycha gibba* Pic. 6—*Bicellonycha lineola* Blanchard. 7—*Pyrogaster squalidus* E. Olivier. 8—*Pyrogaster moestus* (Perty). 9—*Macrolampis olivieri* Pic. 10—*Macrolampis attenuata* Gorham. 11—*Heterophotinus limbipennis* DuVal. 12—*Lucidota atra* G. A. Olivier. 13—*Lucidota diaphanura* Gorham. 14—*Lucidota discolor* Gorham. 15—"Lucidota" *thoracica* G. A. Olivier. 16—*Lucidina puerile* E. Olivier. 17—*Ellychnia corrusca* Linnaeus. 18—*Luciola chinensis* Linnaeus. 19—*Luciola melaspis* Bourgeois. 20—*Luciola cruciata* Motschulsky. 21—*Luciola ovalis* Hope, terminal ventral segments, luminous areas not shaded. 22—*Colophotia praeusta* Eschscholtz. 23—*Colophotia praeusta* Eschscholtz, terminal abdominal segments.



